0.1 mm (-1.13 to 1.64 mm), -0.1 mm (-1.89 to 1.90 mm), and -0.3mm (-2.88 to 1.25 mm). There were 70/221 (32%) fractions with deviation exceeded 2 mm in any direction, with an average duration of 26% of treatment time. While, there were 19/221 (8.6%) fractions with deviation exceeded 3 mm in any direction with an average duration of 6.3% of treatment time.

Conclusion: 4D-TPUS provides an accurate and noninvasive method for real-time tracking of prostate in radiation treatment. We reported the first tracking data from Asia populations. These data can help to understand the intrafraction motion of the prostate, and may allow a reduction of treatment margin.

PO-0880

Clinical implementation of 5DCT workflow

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Purpose or Objective: To implement a quantitative clinical breathing motion characterization technique that employs a 5D motion model.

Material and Methods: We have employed a research breathing motion model and CT acquisition technique into clinical service, supporting lung cancer radiation therapy. The workflow employs 25 fast helical CT scans that are acquired using low mA, fast rotation (0.28s) and a pitch of 1.2 to scan the lungs in approximately 1 s, acquired alternately head to foot and foot to head. A breathing surrogate device, consisting of a hollow sealed bellows-shaped tube, is stretched around the abdomen. The air pressure in the tube is measured using a pressure transducer and the transducer voltage is used as the surrogate. Each slice is assigned a breathing phase according to the breathing surrogate measured at the point in time the scan was acquired. The breathing amplitude and the breathing rate define the breathing phase, allowing the model to explicitly manage breathing amplitude variations as well as breathing hysteresis. The scans are deformably registered to the first scan, arbitrarily assigned as the reference scan. The deformation vectors along with the breathing phases are coupled with a breathing motion model that linearly relates breathing motion to the amplitude and rate of breathing. The 25 scans are averaged at the reference phase geometry to reduce image noise, and the averaged scan deformed to user-defined breathing phases. For the first clinical implementation, we provide 8 static images at breathing phases corresponding to equally spaced breathing amplitude percentiles from the 5th percentile to the 95th percentile and back in equally spaced steps. The model is used to reconstruct the original 25 scans and compare the reconstructed to original scans using deformable image registration, providing a measure of model error. The clinician is provided not only the phase images for planning but estimates of the motion model error presented as colormaps of the model discrepancy.

Results: The protocol provides artifact-free images for contouring and previous research studies have shown that the overall accuracy of the proposed workflow is approximately 2 mm, with severely irregularly breathing patients having only slightly reduced accuracy. The protocol allows the clinician, for the first time, to access quantitatively validated breathing gated CT scans that are related to the overall breathing pattern statistics and that come with accuracy estimates.

Conclusion: While the clinical 5D protocol increases the quantitation available to clinicians, it is only the first step in the next generation of breathing motion modeling and breathing motion mitigation strategies made possible by the quantitative nature of the protocol. Further automation will enable the clinic to greatly increase the efficiency and efficacy of selecting and evaluating competing motion mitigation strategies.

PO-0881

Patient selection for DIBH technique for left sided breast cancers: Impact of chest wall shape

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Purpose or Objective: Deep inspiratory breath hold (DIBH) technique delivers less dose to heart and left lung during radiotherapy for left sided breast cancers. But the benefit is not uniform in all patients. We analyzed the impact of shape of the chest wall (CW) in predicting benefit with DIBH technique.

Material and Methods: All patients of left sided breast cancer undergoing radiotherapy at our centre in the last one year were analyzed. All the patients underwent 2 sets of planning scans-one in DIBH phase and the other in free breathing (FB) phase. DIBH patients were monitored in prospective mode with the help of Varian real time position management system system. For patients who underwent mastectomy, the shape of the CW was assessed on visual inspection and confirmed on the FB planning CT (pCT). For patients with intact breast, the CW excluding the breast was contoured on the FB pCT to evaluate the shape. CW angle (CWA)-angle measured at mid chest level and is made by the tangent to the most curved portion of chest wall with any line parallel to the couch was computed.

Results: 36 patients were found to have curved CW and 17 (32%) were found to have flat CW. All the 17 patients with flat CW had CWA<30 and all with curved CW had CWA>30. In patients with curved CW mean left lung V20 (V20), mean heart dose (MHD) and mean left anterior descending artery (LAD) dose were significantly less with DIBH technique compared to FB plans, (12% vs. 19%, p=0.001, 1.2Gy vs. 5.5Gy, p<0.000, 16.6Gy vs. 29.1Gy, p<0.000 respectively). In patients with flat CW, there was no benefit seen with DIBH scans compared to FB scans with respect to V20, MHD and mean LAD {21% vs. 22.3% (p=0.78), 5.9Gy vs. 6.5Gy (p=0.19) and 29.1Gy vs. 28.9Gy (p=0.9)} respectively. In patients with curved CW, the NTCP for cardiac mortality was less compared to FB plans (0.25% vs. 4.5%, p<0.001) which was not the case in flat CW patients (4.2%, p=0.86)

Conclusion: Patients with curved CW had a significant benefit with DIBH technique compared to flat CW. CW shape, which is easy to determine, is an effective tool to identify patients suitable for DIBH technique. For patients with flat CW other techniques should be explored to address cardiac doses.

PO-0882

Abdominal organ motion during breath-hold measured in volunteers on MRI: inhale and exhale compared

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Purpose or Objective: Breath-hold (BH) techniques, used to eliminate respiratory-induced tumor motion, are in radiotherapy often implemented without clear feedback and characterization of the residual geometric uncertainties. We measured the motion of the pancreatic head and of the diaphragm during four different 1-minute BHs (2 inhale and 2 exhale) in healthy volunteers using MRI. The aim was to investigate which BH type produced the most stable anatomy